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ABSTRACT

Guided by the assumption that teaching methods found successful with the majority cultural group can be utilized effectively with Mexican American students, except where there is clear, significant research evidence to the contrary, the model suggests an instructional approach to improve mathematics achievement of elementary Mexican American students. The model follows a format of planning, implementation, and assessment of instruction, and is modified relative to the influence of language development, low-income parents, and classroom climate on the academic achievement of Mexican Americans. Planning encompasses identification of cognitive entry levels of performance in language and mathematics, externalization of objectives, and selection of instructional techniques and materials. Implementing instruction requires effective use of allotted instructional time in a class format providing set induction, presentation of new material, supervised practice with feedback, homework, and review. To achieve optimum results, student/teacher interaction during implementation should emphasize correct oral English and Spanish usage, corrective feedback and reinforcement, equal expectations for Mexican American students as for the majority, and teacher indication that students are expected to learn because they are capable of learning. Assessment includes both formative and summative assessments of student achievement made in relation to the stated objectives and assessment of effectiveness of instruction through teacher self-evaluation and colleague observation. (NEC)

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A Model For Mathematics Teaching Effectiveness for Mexican-American Students

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Numerous attempts have been made to explain the academic under-achievement of Mexican-American students. These explanations, by and large, have centered on intrinsic psycholinguistic factors such as deficient I.Q., a language barrier, and an inferior culture, as well as other similar factors (Hernandez, 1973). Recent results, however, challenge these interpretations. For example, Kagan and Buriel (1979) and Nelson, et. al., (1980) claim that Mexican-American children are not consistently different in their locus of control, self-esteem or field dependence/independence when compared to Anglo-American children. Other research results summarized by Hernandez and Descamps (in press) suggest the same conclusion.

It is the purpose of this presentation to describe an eclectric model of instruction derived from results of empirical research, that is designed to increase Mexican-American students' mathematics achievement. Several assumptions have been made relative to the development of the model.

1. General learning principles apply across cultural groups, e.g., a behavior is learned if it is reinforced, and extinguished when it is ignored, regardless of cultural group.
2. Certain cultural and social factors, in this case language and economics, cause differences in learning achievement unless addressed properly through appropriate methods and materials.
3. The problem of under-achievement of the Mexican-American cannot be resolved by seeking answers in supposed cultural differences.
4. Methods of teaching found successful with the majority cultural group can be utilized effectively with Mexican-American students, except in those instances where there is clear significant research evidence to the contrary.

The Model

The purpose of the proposed mode is to suggest an instructional approach based on results of research to improve the mathematics achievement of Mexican-American students. Only three significant differences are clearly identified in the research literature as affecting Mexican-American academic achievement. Research clearly identifies language and economics as contributing factors while strongly suggesting that classroom climate, or ambience, is a critical aspect in optimizing learning by Mexican-Americans. Hence, guided by assumption #4, above, the proposed model follows a format of planning, implementation and assessment of instruction, and is modified where appropriate, relative to the influence of language development, low-income of parents, and classroom climate on the academic achievement of Mexican-Americans.

I. Planning

Clearly, traditional models of instruction begin with the planning phase, assuming that effective instruction does not occur frequently and is consistent if not carefully planned. Thus, the first phase in the proposed model is the planning stage.

Effective instruction, in the case of the Mexican-American student, addresses the majority group that <u>in general</u> speaks a language different from that of the majority group and belongs to a socio-economic group characterized by low-income. In this regard, then, the model proposes a diagnostic-prescriptive approach resulting in a modified form of mastery learning. The following areas of emphasis are outlined.

<u>Cognitive entry competence</u>. One of the important aspects of effective planning is the determination of the learner's cognitive entry level of performance. Since language development has been identified as a significant factor affecting learning for Mexican-Americans, this factor must be included in the first phase

of the determination of the child's academic competence. For Mexican-American children, Spanish language competence must be assessed, as well as English.

In addition to an identification of cognitive entry levels of performance in language, entry levels must also be identified in mathematics. The child can then be placed in a program that will help him/her progress in language and mathematics development optimally. For example, a child may be found to be monolongual Spanish, on entry at the first grade. (He could have been found at a transition level having mostly Spanish and some English competence or at a bilingual level having the capacity to learn in either Spanish or English) In this case, he is assigned to a classroom in which Spanish is the language of instruction in content areas while beginning skills in reading and other language arts are begun in English. In this classroom he is taught mathematics in Spanish. Additionally, a mathematics assessment to identify his entry skills further must be done in Spanish.

On the other hand, if it is determined the student understands English to the extent he/she can profit from instruction, then instruction can proceed in English. It is important, however, to remember that the student's competence in Spanish must be maintained regardless of degree of English competence (Kessler & Quinn, 1980; Plante, 1977) by placing the student in a transition or in bilingual program. Students' mathematics achievement will increase if a program of Spanish language competence is maintained. Thus, diagnostic procedures in mathematics must take into consideration language competence as well as mathematics competence while the acquisition of subject matter must be addressed through the use of methods and materials that depend on the level of language competence in English and/or Spanish as well as the level of academic skills of the student. The mathematics program is then planned on the basis of identified <u>mathematics</u> and <u>language</u> entry skills.

Use of objectives. Because Mexican-Americans, in general, are in low-income levels, methods found successful with low-income students are suggested in this model. One such strategy is the use of a highly structured program based on teaching by objectives. Achievement is increased when students are given information relative to the lesson objectives prior to the learning process, especially if the objectives emphasize the same things emphasized in the instructional materials used (Denham & Liberman, 1980). Progress can be monitored consistently ensuring students do not fall into the under-achieving category early in their school careers, if at all. Furthermore, the externalization of objectives guards against development of a "different", modified or simplified set of objectives for Mexican-American students. For example, effective programs such as Direct Instruction (Silbert, et. al., 1981) or Reisman (1978) program can be used in the identification of appropriate mathematics objectives and in developing the appropriate structure. Once the objectives are identified, prerequisites can then be identified and incorporated in the review or taught to ensure effective instruction (Denham & Lieberman, 1980).

Instructional techniques and materials. At this point in planning, instructional techniques to be used in particular lessons are identified. For example, Mexican-American students can be found to be very aggressive if they compete in groups or teams, but usually not as individuals. Their preferred strategy can be used in helping them drill to memorize number facts, or develop skill in particular algorithms, or problem-solving. Preferred materials can be identified and made available. These include materials that relate to the neighborhood or to students' families. The students can be encouraged to develop problem examples on their own that reflect their particular preferences. By carefully considering the children's preferences in instruction, a warm/supportive climate is developed.

Planning that includes the identification of objectives, prerequisites, strategies and instructional materials must be done on a yearly basis, then modified and detailed for weekly and daily implementation to ensure that consistent, effective teaching occurs every day.

II Implementation

In implementing instruction, the effective use of the alloted time for instruction is critical for Mexican-Americans. Teachers of children of low-income families are relatively unsuccessful in motivating students to complete and return homework. Yet, research results indicate that homework, as one aspect of the use of academic learning time (Carnine & Gersten, 1982) is an important factor in mathematics achievement. Given this condition, then, it becomes critical that more significance be given to the instructional activities in the classroom. Only those activities that optimize engaged academic time should be selected.

Management of instructional time. In planning daily activities emphasizing consistent review of cumulative skills, supervised practice in which opportunities for corrective feedback are plentiful (Evertson, Emmer & Brophy, 1980; Good and Grouws, 1977), and use of more low order questions (Rosenshine, 1976) in relation to higher order questions will enhance mathematics learning.

The model proposes, then, that implementation of instruction in the alloted class time follow a format similar to that given below:

1. Set induction -- setting instructional climate; expression of purpose and objectives; review of prerequisites, checking of homework.
2. Presentation of new material with use of visuals, concrete, other models, with an emphasis on content.
3. Supervised practice with appropriate feedback; teacher directed, relatively little time used in silent individual seatwork compared to whole-groups

activity; variety of large-goup activites; appropriate pacing of instruction,

4. Homework assigned where teacher deems practicable, and
5. Periodic review of content, skills, problem-solving performance.

During the implementation of instruction, there is emphasis on correct oral expression in English or Spanish during all phases of the instructional time. At this time modified plans for both the gifted and the remedial student are implemented.

Interaction with students. At the time of implementation of instruction, student/teacher interaction is at a maximum. To ensure that this interaction yields optimum results, a classroom climate that is warm, supportive, and facilitating must be maintained. The model proposes the following aspects of student/teacher interaction guide the discussion.

1. Correct English and Spanish usage must be modeled by the teacher at all times. Use of Spanish, the students' first language, indicates an acceptance of the students' culture and thereby her/his acceptance by the school, and the teacher. Acceptance of the language helps in creating a supportive ambience.
2. Corrective feedback must be provided students during all phases of interaction.

Teachers must respond in ways that are unequivocal in focus, i.e., information given promptly to a student's response must convey that the subject matter is being perceived either correctly or incorrectly. If the teacher wishes to praise or encourage students to motivate them, the teacher's behavior must indicate this clearly. Thus, the student will not misundertand the reason for the praise. For example, if a student's response is incorrect, then "Good try, but try again." or "Good guess, but that's not correct." will communicate that the student has not

captured the idea, but that the teacher is pleased with the participation. If a student's response is correct, then "Good, you have the right idea." will convey that the subject matter is understood correctly.

3. If a student responds incorrectly, he/she cannot be abandoned to reorganize his/her perceptions of the subject matter. After the correct response has been given by another student or teacher, the teacher returns to the first student and asks the same question, a similar question, or asks for a response indicating the student has attempted to incorporate the idea correctly. Thus, the teacher provides an opportunity for the student to respond correctly and be reinforced in his/her behavior.
4. Praise is important to Mexican-Americans and must be given for the performance of required tasks at appropriate levels of competence and not to control discipline. Furthermore, students must be given appropriate standards by which they may judge their actual school performance and progress realistically (Engstrom, 1981; Espinosa, et. al., 1979). Minority students tend to overestimate their school success due to a lack of realistic information relative to their actual performance. Thus, overall expectations and requirements for content and level of mastery desired must be the same for Mexican-American students as for the majority, although methods and materials may differ depending on individual students.
5. Self-correction can be an important approach to providing corrective feedback while being supportive of a students' efforts in mathematics, and maximizing the opportunities available to praise the student and thus reinforce learning. The teacher can ask a question, pause, call on an individual by name, and prompt the student when there is hesitation to give him/her a chance to give the correct response in order to reinforce

that response; or, if the student gives an incorrect answer, indicate that the answer is incorrect and give the student a "second change." Every opportunity to reinforce a correct response must be sought.

6. Teacher expectations can have an enhancing or a debilitating effect on students, but more particularly with Mexican-American students. Every opportunity possible must be taken to indicate to the student that he/she is expected to learn because he/she is capable of learning (Figueroa & Gallegos, 1980). In providing students opportunities for success, as described above, the student receives the message that he/she is expected to learn. Additionally, if the student is made aware of the objectives that must be attained and then given an opportunity to see the results of his/her successful efforts in that regard the student is encouraged and achieves a sense of accomplishment. This can become an important strategy to reduce students' mathematical anxiety.

III. Assessment

The third and final step in the proposed model includes first, assessment of student achievement, and second, assessment of effectiveness of instruction. Assessment is a necessary component for the evaluation of achievement and also for the evaluation of instruction. Without evaluation of student achievement, there can be no direction given to further instruction, and similarly, without evaluation of effectiveness of instruction, there can be no improvement of teaching.

Student Achievement. Student achievement can be assessed in two ways. Formative assessment is informal, informative and indicative of the current stage of understanding a student has achieved. Formative assessment is an on-going process, conducted at all phases of instruction as opposed to a summative assessment which

is indicative of the level of competence a student has achieved at some terminal point in instruction. Summative assessment, then, is formal, conducted at a specific point in time and indicative of the progress made in a unit, a course or at graduation. Both formative and summative assessments are made in relation to the stated objectives.

During formative assessment the teacher has an opportunity to be supportive of a child's efforts, and by asking questions and/or requiring performance of specific tasks, assess the current progress made, while giving encouragement for continued work, or praising when correct responses or completion of assigned tasks are demonstrated. The climate, during this process, must be warm, accepting, but demanding of correct responses and high quality of task performance. If, during some aspect of formative assessment the desired performance is not forthcoming, the teacher can diagnose the problem promptly for gaps in information, misunderstandings, lack of prerequisites, etc., make these corrections and help the student achieve the required objective before a summative assessment is required, e.g., six-weeks test, unit test, or TABS.

Evaluation of Instruction. Consistent and frequent evaluations of the effectiveness of instruction need to be made if children are to receive a sound education. Teachers can make self-evaluations through the use of check-lists, have their colleagues visit them to make classroom observations of specific teacher performances such as student/teacher interaction, use of corrective feedback, use of materials, or other elements of the proposed model.

Summary

A final thought needs to be made in relation to teaching effectiveness for Mexican-American students. In the final analysis, demonstrated student achievement in mathematics must be the ultimate criterion of effective instruction. If students do not learn then it becomes the professional obligation of the dedicated

teacher to seek ways to help students achieve the objectives. If some fortunate individuals are having relatively good success in teaching mathematics to Mexican-American students, then it is also their professional obligation to become more successful. It is to this end that this model is proposed.

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